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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P045037PCT BOT/jdo	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP 03/00698	International filing date *(day/month/year)* 23.01.2003	Priority date *(day/month/year)* 24.01.2002
International Patent Classification (IPC) or both national classification and IPC B63B22/02		
Applicant SINGLE BUOY MOORINGS INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
22.08.2003	27.04.2004
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer van Rooij, M Telephone No. +31 70 340-4177

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP 03/00698

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

3-7	as originally filed
1, 2	received on 26.02.2004 with letter of 26.02.2004

Claims, Numbers

4-18	as originally filed
1-3	received on 26.02.2004 with letter of 26.02.2004

Drawings, Sheets

1/10-10/10	as originally filed

2. With regard to the **language,** all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-18
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-18
Industrial applicability (IA)	Yes:	Claims	1-18
	No:	Claims	

2. Citations and explanations

   see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1: WO 99 62762 A (SINGLE BUOY MOORINGS ;POLLACK JACK (MC)) 9 December 1999 (1999-12-09)

D2: US-A-3 778 854 (CHOW P) 18 December 1973 (1973-12-18)

D3: US-A-4 138 751 (KENTOSH JAMES M) 13 February 1979 (1979-02-13)

D4: EP-A-0 907 002 (DEEP OIL TECHNOLOGY INC) 7 April 1999 (1999-04-07)

D5: NL-A-8 701 849 (BLUEWATER TERMINAL SYSTEMS NV) 1 March 1989 (1989-03-01)

D6: NL-A-7 515 095 (SINGLE BUOY MOORINGS) 28 June 1977 (1977-06-28)

1.0) The document D5 discloses (the references in parentheses applying to this document):
Mooring buoy (2) comprising a submerged part and a part extending above water level, the part above water level comprising a fluid outlet duct (6) the buoy being anchored to the seabed via substantially taut anchor legs (9,11) , a substantially horizontally oriented fluid transfer duct (3) being attached to a connector of the buoy, the buoy comprising a substantially vertical fluid duct between the connector and the outlet duct (the height difference between bottom and top of buoy 2 per definition warrants a substantially vertical fluid duct), and no hydrocarbon transport riser extending from the seabed to the buoy (2).

from which the subject-matter of claim 1 differs in that there is a specification of the dimensions of the buoy, and a non-rigid connector between (external) horizontal fluid duct and buoy.

The problem to be solved by the present invention may therefore be regarded as improving the motion characteristics of the buoy itself and avoiding high (fatigue) stresses at the connector.

The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reason:
The feature of a non-rigid connector and the slender shape of a buoy which is

there to improve its motion characteristics is described in document D1 as providing the same advantages as in the present application. The skilled person would therefore regard it as a normal option to include these feature in the mooring buoy described in document D5 in order to solve the problem posed.

The further specification of the selection of an overall length and underwater diameter of the buoy from the ranges known to the person skilled in the art can only be regarded as inventive, if the mentioned overall length and diameter present unexpected effects or properties in relation to the rest of the range. No such (unexpected motion characteristic) effects or properties are indicated in the application.

In fact the person skilled in the art is well known with the beneficial motion characteristics of a slender vertical cilindrical body, even further enhanced if its waterline area is smaller than the cross section of the underwater body. Thus the introduction of the " a lower section(13") in the subject-matter of claim 1 is not inventive. And while this " a lower section" is not further specified with respect to the assumed upper section, one could understand this " a lower section" to encompass as much as the whole of the underwaterbody.

Therefore claim 1 is not considered to involve an inventive step and claim 1 does not fulfill the requirement of Article 33(3) PCT.

2.0) The remaining dependent claims do not appear to contain any additional features which, in combination to any claim to which they refer, meet the requirements of the PCT with respect to inventive step (Article 33(3)), the reasons being that the additional features of the subject-matter of the following claims are known from either document D5 or D1, or from both documents, or are in fact non-interacting additional features generally known to the person skilled in the art. Such a feature can be implemented without the other feature and vice versa. Therefore these features are considered merely a succession of features instead of a combination of features.

2.1) D5 (fig.1 bottom of 2) as well as D1(at connector 22) also disclose a connector

being located at the bottom of the buoy, and thus also located at or near the lower section.

2.2) D5 (anchor leg 9 at 2, but also the spread mooring system at buoy 1) as well as D1 (anchor legs 8 at buoy 3) also disclose anchor legs being located at or near the lower section/bottom of the(a) buoy.

2.3) Claim 4 describes two sections of the buoy with different size. With the larger sized section underwater and the smaller sized section penetrating the watersurface. This too is a matter of normal design procedure with known beneficial motion effects. See the explanation in paragraph 1.0 and for example D2 fig 1.

2.4) Claim 5 describes the use of a bearing connection between lower and upper buoy section. This is common practice for a connection between two freely rotating elements. See for example D2 (49 versus 26).

2.5) Claim 6 describes the implementation of a hinge joint between the two buoy sections. Although not widely used, this feature is a known option for the person skilled in the art. The features of this claim 6 have already been employed for the same purpose in an oil offloading buoy anchored to the seabed, see document D3, fig.1.

2.6) Claim 7 describes the implementation of a rotatable head and swivel on top of the buoy (fluid duct). This is also common practice in the art of the skilled person. See for example D2 fig 1.

2.7) Claim 8 describes the size of the rotatable head and that it has a buoyancy chamber. This comes within routine design options and thus cannot be regarded as inventive.

2.8) Claim 9 describes the support connection between rotatable head and buoy with a shaft supporting the head via an axial bearing and a slide bearing supporting the shaft at the lower section. Support connections such as this are generally known. The skilled person would therefore regard it as a normal option to include this feature in an offloading buoy with rotating head.

2.9) Claims 10,12 and 16 merely describe the location of an object on the buoy. It concerns the mooring connector on the upper part of the buoy (claim 9), the mooring connector parts circumferentially (claim 11), and the connector near the anchor legs attachment point (16).
These generally known features are merely a design option and bear no inventive skill to implement (see for example document D4 fig.1) .

2.10)Claim 11 describes a bearing that allows the free rotation of the mooring connector around the buoy vertical axis, which is a routine design feature and thus not inventive.

2.11)Claim 13 describes a feature which has been mentioned in claim 1; "..transfer duct comprising a flexible joint at or near the connector" bears the same feature as "..transfer duct being attached to a connector ..(..) .in a non-rigid manner.." Therefore the comments given for claim 1 also apply here.

2.12) Claim 14 describes a material to be used for the transfer duct. It is generally known that steel is one of the possibilities to manufacture a transfer duct. There is no inventive skill required to come to this alternative.

2.13)Claim 15 describes the shape of the transfer duct under water between two support points. Establishing a curved trajectory such as the U-shape, or W-shape with additional floaters support, is known from D1 (U) and D5(W) and bears thus no inventive activity.

2.14)Claims 17 and 18 describe the implementation of ballast means in the buoy, be it fixed matter or fluid (ballast compartment). Having ballast for a floating buoy is not inventive as it is common practice, see for example documents D2 and D6.

Therefore claims 2-18 do not meet the requirements of Article 33(3) PCT.

26.02.2004

Article 34

(57)

Wave motion absorbing offloading system comprising a slender mooring buoy

The invention relates to a mooring buoy for a hydrocarbon offloading system comprising a submerged part and a part extending above water level.

Such a hydrocarbon offloading system is known from FR-A-2 768 993. In this publication, an offshore platform or FPSO is connected to a mooring buoy having catenary anchor legs. The buoy is connected to the floating structure via a tension line comprising a compartmented tube having positive buoyancy. The tube supports hydrocarbon transfer lines and is attached on one end to the FPSO whereas the fluid transfer lines are connected to the FPSO by a flexible line section. On the other side, the tension line is connected to the anchor leg of the buoy whereas the fluid transfer line is connected to the buoy via a flexible hose section. An excursion of the FPSO in any direction due to winds or currents, results in an excursion of the buoy of substantially the same amplitude. The distance between the buoy and the FPSO is maintained substantially constant whereas the submerged pipeline does not need to accommodate relative displacements between the buoy and the FPSO.

The known system has as a disadvantage that submerged pipelines of longer length will still be subjected to fatigue problems related to (local) compression and buckling of the fluid transfer line. The known fluid transfer line is connected to the tension member along its whole length, which tension member is part of the total mooring configuration. As a result, the fluid transfer line will be forced to follow the excursions of the buoy and the FPSO whereas the fluid transfer line itself does not contribute to the mooring system. The fluid transfer line has flexible hoses at each end and is not horizontally tensioned. This, in combination with the fact that the FPSO is relatively large and the buoy is small and have different (horizontal) motion behavior in view of their large size difference, leads to horizontal motions and variations in tension on the tension member, which motions will be directly transferred to the steel transfer line and which will create axial stresses as the ends of the steel pipe of the transfer line move in different manner. This results in local fatigue, compression and buckling of the transfer line. The known construction is unsuitable for transfer lines longer than 500 m and using a relatively large shuttle tanker moored to the relatively small buoy. In such case both floating constructions known from FR-A- 2 768 993 will have more or less independent motions and excursions which can not be coupled with the very long

tension member, increasing the danger of slackening and buckling and compression of the pipeline.

Other systems using large steel pipes as offloading lines for deep water single point mooring terminals, reducing constant wave motion excitations imposed at the Single Point Mooring (SPM)-buoy and at the offloading risers is described in GB-A-2,335,723 and in US-A-6,109,989. In these known mooring configurations, the fluid transfer lines are directly coupled to the buoy such that vertical and horizontal motions will be transferred directly to the risers, hence creating fatigue problems in the steel pipes resulting in a fatigue life which is too small for the required field (which is typically 25 times 10 or 250 years). Such fatigue problems arise when first order, wave induced high frequency motions of periods of about 10 s occur and cause relatively a small drift of a buoy moored in 1000 m water depth of around 3 m. Another fatigue problem for large steel risers is created by second order low frequency motions which could, at a water depth of 1000 m have periods in the range of 1-5 minutes and can cause a relative displacement of an order of magnitude of 400 m between the two floating bodies (so called slow drift motions).

In WO 99/62762 the problem of compression and buckling of the steel fluid transfer line is solved by a compliant submerged pipeline system wherein tensioning weights are added at the end parts of the horizontal pipeline resulting in a horizontal tensioning force on the pipeline ends and thus avoiding the danger buckling and compression.

It is an object of the present invention to provide a mooring buoy for an offloading system which is especially suitable for deep water in which wave motions on the buoy are minimized and fatigue problems near the connection of the substantially horizontal fluid transfer duct is reduced.

Thereto, the mooring buoy of the present invention comprises a submerged part and a part extending above water level, the part above water level comprising a fluid outlet duct for attaching to a vessel, the buoy being anchored to the seabed via substantially taut anchor legs, a substantially horizontally oriented fluid transfer duct being attached to a connector preferably at or near the bottom of the buoy in a non-rigid manner, the buoy comprising a substantially vertical fluid duct between the connector and the outlet duct and a mooring connector for attaching to a mooring line of a vessel, wherein

(57)

Claims

1. Mooring buoy (6) comprising a submerged part (12, 13) and a part (11) extending above water level, the part above water level comprising a fluid outlet duct (24) for attaching to a vessel (7), the buoy being anchored to the seabed via substantially taut anchor legs (27, 28), a substantially horizontally oriented fluid transfer duct (15) being attached to a connector (17) of the buoy (6) in a non-rigid manner, the buoy comprising a substantially vertical fluid duct (21) between the connector (17) and the outlet duct (24) and a mooring connector (9) for attaching to a mooring line (8) of the vessel (7), wherein the length (L) of the buoy is between 20 m and 70 m and the ratio of the diameter (D) of a lower section (13) of the buoy and the length (L) being below 0.3, preferably below 0.2, no hydrocarbon transport risers extending from the seabed to the buoy (6).

2. Mooring buoy (6) according to claim 1, wherein the connector (17) is located at or near the lower section (13), preferably at or near the bottom (16) of the buoy.

3. Mooring buoy (6) according to claim 1 or 2, the anchor legs being located at or near the lower section (13) of the buoy, preferably at or near the bottom (16) of the buoy (6).